

WHAT IS CLAIMED IS:

1. A light-controlled light modulator for  
modulating, in response to light intensity of first  
5 input light with an arbitrary wavelength, second input  
light with a wavelength identical to or different from  
a wavelength of the first input light, said light-  
controlled light modulator comprising;

an optical combiner/splitter for combining the  
10 first input signal light and the second input light,  
and for distributing them to a plurality of ports;

phase modulators, which are connected to the  
plurality of ports, including media that vary their  
refractive indices in response to the light intensity  
15 of the first input light;

an optical combiner for combining outputs from  
said phase modulators; and

optical branching-delaying means for branching  
and delaying the second input light.

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2. The light-controlled light modulator as claimed  
in claim 1, wherein said optical combiner/splitter for  
combining the first input light and the second input  
light, and for distributing them to a plurality of  
25 ports, said phase modulators, which are connected to  
the plurality of ports, including media that vary  
their refractive indices in response to the light

intensity of the first input light, and said optical combiner for combining outputs from said phase modulators constitutes a symmetric Mach-Zehnder optical circuit.

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3. The light-controlled light modulator as claimed in claim 2, wherein said optical branching-delaying means comprises a loop-type optical interferometer.

10 4. The light-controlled light modulator as claimed in claim 3, wherein a length of said media whose refractive indices vary in response to the light intensity of the first input light is shorter than a difference between a first length and a second length,  
15 the first length being equal to a length from said branching-delaying means for branching and delaying the second input light to said phase modulators via said optical combiner/splitter that combines the first input light with a first branched part of the second  
20 input light and distributes them to the plurality of ports, and the second length being equal to a length from said optical branching-delaying means to said phase modulators via said optical combiner that combines the outputs from said phase modulators and  
25 couples them to a second part of the branched second input light.

5. The light-controlled light modulator as claimed in claim 4, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

6. The light-controlled light modulator as claimed in claim 3, further comprising a plurality of controllers for controlling states of said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

7. The light-controlled light modulator as claimed in claim 6, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

8. The light-controlled light modulator as claimed in claim 3, wherein the media of said phase modulators with the media whose refractive indices vary in response to the light intensity of the first input light have a cross section that varies along a propagation direction of light.

9. The light-controlled light modulator as claimed

in claim 8, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

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10. The light-controlled light modulator as claimed in claim 3, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light  
10 intensity of the first input light.

11. The light-controlled light modulator as claimed in claim 2, wherein said optical branching-delaying means consists of an asymmetric Mach-Zehnder optical  
15 circuit.

12. The light-controlled light modulator as claimed in claim 11, wherein semiconductor optical amplifiers are used as said phase modulators including the media  
20 whose refractive indices vary in response to the light intensity of the first input light.

13. The light-controlled light modulator as claimed in claim 2, wherein semiconductor optical amplifiers  
25 are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

14. The light-controlled light modulator as claimed in claim 2, further comprising means for controlling the intensity of the input light.

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15. The light-controlled light modulator as claimed in claim 14, wherein said means for controlling the intensity of the input light comprises an optical amplifier with a gain control function.

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16. The light-controlled light modulator as claimed in claim 1, wherein said optical branching-delaying means comprises a loop-type optical interferometer.

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17. The light-controlled light modulator as claimed in claim 16, wherein a length of said media whose refractive indices vary in response to the light intensity of the first input light is shorter than a difference between a first length and a second length, the first length being equal to a length from said branching-delaying means for branching and delaying the second input light to said phase modulators via said optical combiner/splitter that combines the first input light with a first branched part of the second input light and distributes them to the plurality of ports, and the second length being equal to a length from said optical branching-delaying means to said

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phase modulators via said optical combiner that combines the outputs from said phase modulators and couples them to a second part of the branched second input light.

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18. The light-controlled light modulator as claimed in claim 17, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light  
10 intensity of the first input light.

19. The light-controlled light modulator as claimed in claim 16, further comprising a plurality of controllers for controlling states of said phase  
15 modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

20. The light-controlled light modulator as claimed  
20 in claim 19, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

25 21. The light-controlled light modulator as claimed in claim 16, wherein the media of said phase modulators with the media whose refractive indices

vary in response to the light intensity of the first input light have a cross section that varies along a propagation direction of light.

- 5 22. The light-controlled light modulator as claimed in claim 21, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

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23. The light-controlled light modulator as claimed in claim 16, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light  
15 intensity of the first input light.

24. The light-controlled light modulator as claimed in claim 16, further comprising means for controlling the intensity of the input light.

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25. The light-controlled light modulator as claimed in claim 24, wherein said means for controlling the intensity of the input light comprises an optical amplifier with a gain control function.

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26. The light-controlled light modulator as claimed in claim 1, wherein said optical branching-delaying

means consists of an asymmetric Mach-Zehnder optical circuit.

27. The light-controlled light modulator as claimed  
5 in claim 26, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

10 28. The light-controlled light modulator as claimed in claim 26, further comprising means for controlling the intensity of the input light.

15 29. The light-controlled light modulator as claimed in claim 28, wherein said means for controlling the intensity of the input light comprises an optical amplifier with a gain control function.

20 30. The light-controlled light modulator as claimed in claim 1, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

25 31. The light-controlled light modulator as claimed in claim 30, further comprising means for controlling the intensity of the input light.



32. The light-controlled light modulator as claimed  
in claim 31, wherein said means for controlling the  
intensity of the input light comprises an optical  
5 amplifier with a gain control function.

33. The light-controlled light modulator as claimed  
in claim 1, further comprising means for controlling  
the intensity of the input light.

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34. The light-controlled light modulator as claimed  
in claim 33, wherein said means for controlling the  
intensity of the input light comprises an optical  
amplifier with a gain control function.

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35. A light-controlled light modulator comprising:  
first optical branching means for branching first  
input light;

optical branching-delaying means for branching  
20 and delaying second input light

a first optical combiner/splitter for combining a  
first branched part of the first input light with a  
first branched part of the second input light, and for  
distributing them to a plurality of ports;

25 phase modulators, which are connected to the  
plurality of ports, including media that vary their  
refractive indices in response to light intensity of

the first input light; and

a second optical combiner/splitter for combining  
outputs from said phase modulators and for branching  
them to a plurality of parts, and for coupling them  
5 with a second branched part of the first input light  
and a second branched part of the second input light.

36. The light-controlled light modulator as claimed  
in claim 35, wherein said first optical  
10 combiner/splitter for combining the first input light  
and the second input light, and for distributing them  
to the plurality of ports, said phase modulators,  
which are connected to the plurality of ports,  
including media that vary their refractive indices in  
15 response to the light intensity of the first input  
light, and said second optical combiner/splitter for  
combining outputs from said phase modulators  
constitute a symmetric Mach-Zehnder optical circuit.

20 37. The light-controlled light modulator as claimed  
in claim 36, wherein said optical branching-delaying  
means comprises a loop-type optical interferometer.

38. The light-controlled light modulator as claimed  
25 in claim 37, wherein a length of said media whose  
refractive indices vary in response to the light  
intensity of the first input light is shorter than a

difference between a first length and a second length,  
the first length being equal to a length from said  
branching-delaying means for branching and delaying  
the second input light to said phase modulators via  
5 said optical combiner/splitter that combines the first  
input light with a first branched part of the second  
input light and distributes them to the plurality of  
ports, and the second length being equal to a length  
from said branching-delaying means to said phase  
10 modulators via said optical combiner that combines the  
outputs from said phase modulators and couples them to  
a second part of the branched second input light.

39. The light-controlled light modulator as claimed  
15 in claim 38, wherein semiconductor optical amplifiers  
are used as said phase modulators including the media  
whose refractive indices vary in response to the light  
intensity of the first input light.

20 40. The light-controlled light modulator as claimed  
in claim 37, further comprising a plurality of  
controllers for controlling states of said phase  
modulators including the media whose refractive  
indices vary in response to the light intensity of the  
25 first input light.

41. The light-controlled light modulator as claimed

in claim 40, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

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42. The light-controlled light modulator as claimed in claim 37, wherein the media of said phase modulators with the media whose refractive indices vary in response to the light intensity of the first input light have a cross section that varies along a propagation direction of light.

43. The light-controlled light modulator as claimed in claim 42, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

44. The light-controlled light modulator as claimed in claim 37, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

45. The light-controlled light modulator as claimed in claim 36, wherein semiconductor optical amplifiers are used as said phase modulators including the media

whose refractive indices vary in response to the light intensity of the first input light.

46. The light-controlled light modulator as claimed  
5 in claim 36, further comprising means for controlling the intensity of the input light.

47. The light-controlled light modulator as claimed  
in claim 46, wherein said means for controlling the  
10 intensity of the input light comprises an optical amplifier with a gain control function.

48. The light-controlled light modulator as claimed  
in claim 35, wherein said optical branching-delaying  
15 means comprises a loop-type optical interferometer.

49. The light-controlled light modulator as claimed  
in claim 48, wherein a length of said media whose  
refractive indices vary in response to the light  
20 intensity of the first input light is shorter than a difference between a first length and a second length, the first length being equal to a length from said branching-delaying means for branching and delaying the second input light to said phase modulators via  
25 said optical combiner/splitter that combines the first input light with a first branched part of the second input light and distributes them to the plurality of

ports, and the second length being equal to a length  
from said branching-delaying means to said phase  
modulators via said optical combiner that combines the  
outputs from said phase modulators and couples them to  
5 a second part of the branched second input light.

50. The light-controlled light modulator as claimed  
in claim 49, wherein semiconductor optical amplifiers  
are used as said phase modulators including the media  
10 whose refractive indices vary in response to the light  
intensity of the first input light.

51. The light-controlled light modulator as claimed  
in claim 48, further comprising a plurality of  
15 controllers for controlling states of said phase  
modulators including the media whose refractive  
indices vary in response to the light intensity of the  
first input light.

20 52. The light-controlled light modulator as claimed  
in claim 51, wherein semiconductor optical amplifiers  
are used as said phase modulators including the media  
whose refractive indices vary in response to the light  
intensity of the first input light.

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53. The light-controlled light modulator as claimed  
in claim 48, wherein the media of said phase

modulators with the media whose refractive indices vary in response to the light intensity of the first input light have a cross section that varies along a propagation direction of light.

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54. The light-controlled light modulator as claimed in claim 53, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light  
10 intensity of the first input light.

55. The light-controlled light modulator as claimed in claim 48, wherein semiconductor optical amplifiers are used as said phase modulators including the media  
15 whose refractive indices vary in response to the light intensity of the first input light.

56. The light-controlled light modulator as claimed in claim 48, further comprising means for controlling  
20 the intensity of the input light.

57. The light-controlled light modulator as claimed in claim 56, wherein said means for controlling the intensity of the input light comprises an optical  
25 amplifier with a gain control function.

58. The light-controlled light modulator as claimed

in claim 35, wherein semiconductor optical amplifiers are used as said phase modulators including the media whose refractive indices vary in response to the light intensity of the first input light.

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59. The light-controlled light modulator as claimed in claim 58, further comprising means for controlling the intensity of the input light.

10 60. The light-controlled light modulator as claimed in claim 59, wherein said means for controlling the intensity of the input light comprises an optical amplifier with a gain control function.

15 61. The light-controlled light modulator as claimed in claim 35, further comprising means for controlling the intensity of the input light.

20 62. The light-controlled light modulator as claimed in claim 61, wherein said means for controlling the intensity of the input light comprises an optical amplifier with a gain control function.